MORE™ User Guide

Mylex Online RAID Expansion™ Enhancement for DACCF Utilities 4.4 and Global Array Manager 2.05

Part Number 771968-D01

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About This Manual

This installation guide covers enhancements to both the Global Array Manager and DACCF Utilities software that implement Mylex Online RAID Expansion™ (MORE™) technology.

Global Array Manager 2.05 is a maintenance upgrade for Global Array Manager 2.0. You must have an existing installation of Global Array Manager 2.0 in order to successfully install this maintenance upgrade.

DACCF Utilities 4.4 fully replaces DACCF Utilities 4.2. DACCF Utilities 4.2 is not required for installation of DACCF Utilities 4.4.

This document will cover only information that is unique to the software upgrades described herein. Specifically:

- General information about Mylex Online RAID Expansion technology.
- Requirements for using MORE.
- How to expand capacity using MORE in DACCF Utilities 4.4.
- How to expand capacity using MORE in Global Array Manager 2.05.

Refer to the Global Array Manager 2 Installation Guide and User Manual (Mylex Part Number 771961) and/or the DACCF Utilities Installation Guide and User Manual (Mylex Part Number 771953) for all other information on these products.

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Chapter 1

Introduction to MORE™

Overview

Mylex Online RAID Expansion™ (MORE™) is a process for adding storage capacity to an existing RAID configuration without having to take the server offline.

MORE either reallocates one (or several) hot spare (standby) drives to an existing RAID drive group, or allocates one (or several) newly-installed drives to an existing drive group. The expansion process *restripes* all of the data on the existing drive group across all of the drives which make up the new drive group (Figure 1-1).

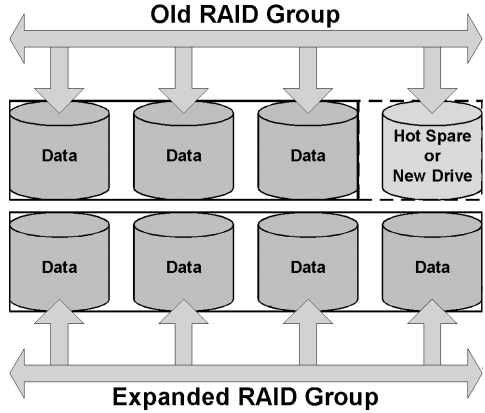

Figure 1-1. MORE Restripes Data Across All Drives in the RAID Group

MORE allows system administrators to manage the changing storage needs of servers equipped with feature-set compatible Mylex DAC960 Disk Array Controllers operating under Windows NT, Novell NetWare, SCO UNIX, and Novell UnixWare[1].

1. MORE can be implemented “offline” under DOS by using DACCF Utilities 4.4.

How MORE is Implemented

MORE is a feature enhancement in Mylex DAC960 P-Family Disk Array Controllers equipped with DAC960 Firmware version 3.5 or above.

MORE is activated and monitored by software. Its RAID capacity expansion capability can be accomplished in one of the following ways:

1. The “Add Drive to Last Pack” feature within the DACCF Utilities 4.4
2. The “Auto Expand Capacity” or “Expand Capacity” features within Global Array Manager 2 (GAM2) version 2.05 client software

RAID expansion using MORE provides a powerful upgrade path for increasing storage capacity when the need arises. As storage requirements increase, MORE not only allows the user to add to the size of an online array, but also to do it remotely through Global Array Manager 2.05.

Operating Characteristics of MORE

The following are operational characteristics of MORE:

- The minimum number of physical drives in the source RAID drive group (pack) is two (2). The maximum is seven (7).
- The maximum number of system (logical) drives prior to adding capacity is 31.
- One (1) to six (6) drives can be added at one time, as long as the total number of physical drives in the drive group will not exceed eight (8).
- The capacity of each added physical drive must be equal to or greater than that of the smallest drive in the source drive group.
- Capacity cannot be added to an array containing a *spanned* system drive.
- If more than one system drive resides on the drive group to be expanded, ALL system drives will be processed at one time.
- The extra capacity can be assigned a new system drive number if so requested by the user.
- No configuration updates are allowed during the expansion process.
- The expansion process will not run if the targeted drive group is already in critical mode.

DAC960 Functions with MORE

When running MORE, the Mylex DAC960 Disk Array Controller operates with the following characteristics:

1. In order to complete the expansion process as quickly and as safely as possible, the controller can give priority to the expansion process over all other I/O requests. (Priority is set with “Rebuild Rate” in the Controller Options dialog box.) Rebuilds, Consistency Checks, and configuration changes are prohibited until expansion has completed.
2. I/O activity continues at a lower rate while expansion is underway.
3. When capacity is added to an existing drive group, MORE carries out the following mapping:

Table 1-1. RAID Level Mappings using MORE

Original RAID Level	RAID Level After Restriping
RAID 0	RAID 0
RAID 1	RAID 0+1
RAID 5	RAID 5
RAID 0+1	RAID 0+1

Note: RAID parameters such as cache line size and write policy are preserved throughout the expansion process.

4. Since expansion requires some time to complete the necessary restriping (depending on the size of the original RAID drive group), the system administrator may carry out this function without being present at the server. The expansion process can be initiated from a remote location.
5. If a drive fails during the expansion process, the controller will complete the restriping before rebuilding the failed drive. This does NOT occur for RAID 0. Under RAID 0, the expansion process will stop in the event of drive failure.
6. The system’s data is protected against power failure. If power to the server or to the storage system is lost during expansion, restriping will resume at the point of interruption after power has been restored.
7. Physical drives may be relocated during power off.

After the expansion has completed, the new capacity must be configured. It is recommended that the new capacity be configured as a new logical drive. Use the Global Array Manager 2.05 or DACCF Utilities 4.4 to optimize the drive settings and RAID levels on the newly added capacity.

Note: Refer to the *Global Array Manager 2 Installation Guide and User Manual* (Mylex part number 771961) or the *DACCF Utilities Installation Guide and User Manual* (Mylex part number 771953).

Requirements

- DAC960 P-Family Controller Firmware version 3.5 or above
- DACCF Utilities 4.4, or
- For use with GAM2, existing, installed Global Array Manager Client Software 2.0 for Windows NT or Windows 95 (the Global Array Manager 2.05 upgrade will only install over a previously-installed GAM 2.0 client) and GAM Server software installed for Windows NT, Novell NetWare, SCO UNIX, or Novell UnixWare.

Chapter 2
Using MORE™ with DACCF 4.4

Overview

DACCF Utilities 4.4 is the first version of the DAC960 configuration utilities to include a method for adding capacity to an existing RAID group (known as a "pack").

Instead of deleting a pack and recreating it with the additional drive(s), a new function called "Add Drive to Last Pack" allows the user to select one or several drives to add *to the last pack that was created*.

> **Note:** A limitation of MORE under DACCF 4.4 is that only the last pack can be expanded (restriped). Packs that were created prior to that pack are not available for automatic capacity expansion using MORE.

Installing DACCF 4.4

Installation of DACCF 4.4 is identical to that of its predecessor, DACCF 4.2. Therefore, installation instructions will not be repeated in this document.

Refer to the documentation that accompanied DACCF 4.2: *DACCF Utilities Installation Guide and User Manual* (Mylex Part Number 771953) for installation instructions.

Adding Capacity Under DACCF 4.4

Procedure

On the Main menu, use the View/Update Configuration option to expand the capacity of an existing RAID group (pack).

1. Select **View/Update Configuration** from the Main menu (Figure 2-1).

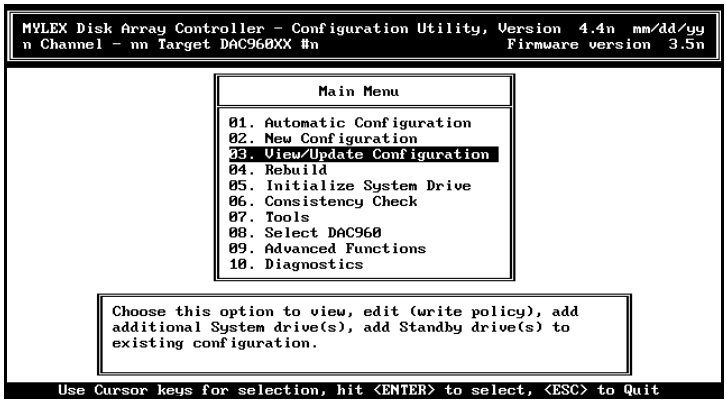
MYLEX Disk Array Controller - Configuration Utility, Version 4.4n mm/dd/yy
n Channel - nn Target DAC960XX #n Firmware version 3.5n
Main Menu
01. Automatic Configuration
02. New Configuration
03. View/Update Configuration
04. Rebuild
05. Initialize System Drive
06. Consistency Check
07. Tools
08. Select DAC960
09. Advanced Functions
10. Diagnostics
Choose this option to view, edit (write policy), add additional System drive(s), add Standby drive(s) to existing configuration.
Use Cursor keys for selection, hit <ENTER> to select, <ESC> to Quit

Figure 2-1. Select View/Update Configuration

The View/Update Configuration menu is displayed (Figure 2-2).

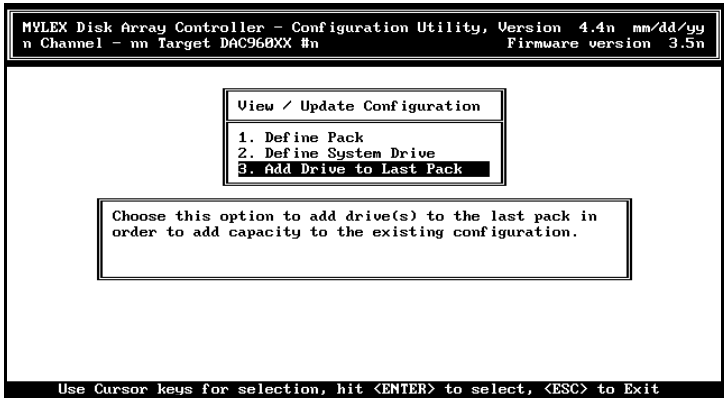
MYLEX Disk Array Controller - Configuration Utility, Version 4.4n mm/dd/yy
n Channel - nn Target DAC960XX #n Firmware version 3.5n
View / Update Configuration
1. Define Pack
2. Define System Drive
3. Add Drive to Last Pack
Choose this option to add drive(s) to the last pack in order to add capacity to the existing configuration.
Use Cursor keys for selection, hit <ENTER> to select, <ESC> to Exit

Figure 2-2. View/Update Configuration Menu: Select Add Drive to Last Pack

2. Select **Add Drive to Last Pack** from the View/Update Configuration menu (Figure 2-2) to request the capacity expansion process.

   If any of the following conditions are true about the last-created pack (the pack with the highest "letter" value in the list), MORE will not be able to add capacity to the pack:

   - The pack consists of a single (JBOD) drive
   - The pack already has eight (8) drives
   - The pack is a "spanned" pack
   - A total of 32 system drives have already been configured.

   The Add Capacity screen is displayed (Figure 2-3).

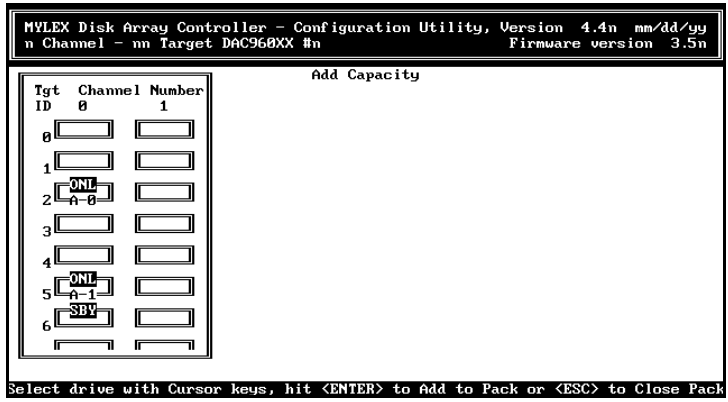

Figure 2-3. Add Capacity Screen

3. Use the arrow keys to position the highlighted bar on a disk device identified as **RDY** (ready/available) or **SBY** (standby/hot spare).

4. Press the Enter key to include it in the expansion process. When a disk is selected for inclusion in the last pack, the identifier of the last pack (A, B, C...) and disk index of the new drive (0, 1, 2...) are assigned, and the disk status changes to **ONL**.

5. Repeat the previous two steps for other drives that you want to add to the last pack, if any.

One or both of the following conditions may prevent DACCF 4.4 from allowing you to select a particular disk device:

- The drive capacity is too small to be used in the pack
- The pack already has eight (8) drives (which may include disk device selections you just made)

6. If necessary, press the ESC key when you have finished your selection. The restriping process is ready to begin, and a warning message appears (Figure 2-4):

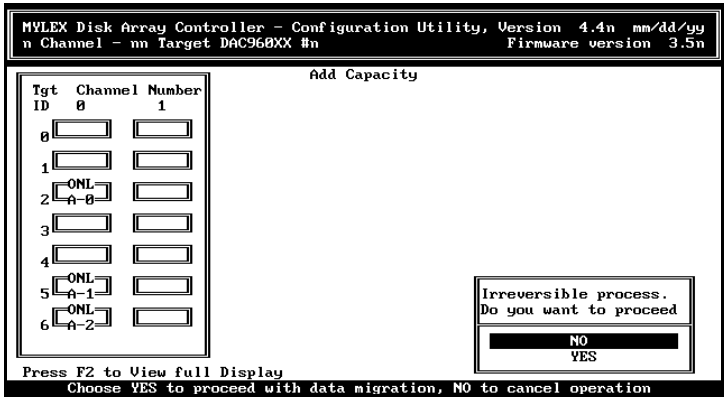

Figure 2-4. Add Capacity Warning Message

- Select **YES** to begin the capacity expansion process on the target pack.
- Select **NO** to cancel the capacity expansion process and return to the previous menu.

Caution

Once the Add Drive to Last Pack process has started, it cannot be interrupted by user intervention. You must allow the process to reach completion.

7. If you chose to proceed with expansion, the Add Capacity status screen (Figure 2-5) appears, showing the progress of data migration (restriping) across the target pack.

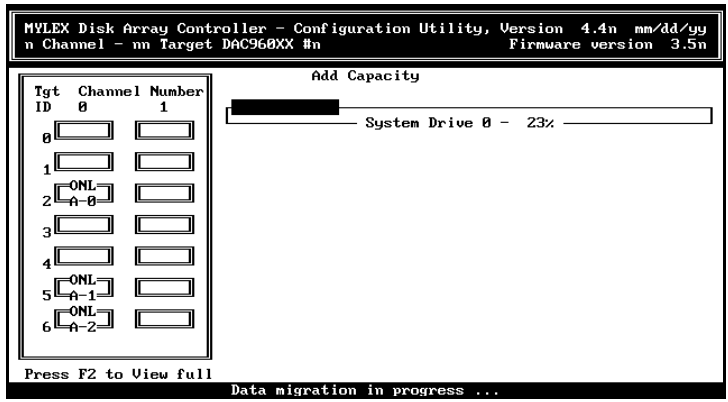

Figure 2-5. Data Migration in Progress

8. At the conclusion of the data migration, a message indicating successful completion will be displayed. Press any key to return to the View/ Update Configuration menu (Figure 2-6).

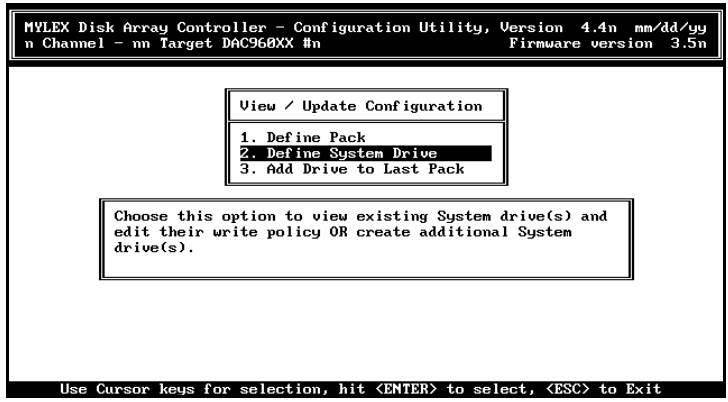
MYLEX Disk Array Controller - Configuration Utility, Version 4.4n mm/dd/yy
n Channel - nn Target DAC960XX #n Firmware version 3.5n
View / Update Configuration
1. Define Pack
2. Define System Drive
3. Add Drive to Last Pack
Choose this option to view existing System drive(s) and edit their write policy OR create additional System drive(s).
Use Cursor keys for selection, hit <ENTER> to select, <ESC> to Exit

Figure 2-6. Pack "A" Was Expanded; Return to Menu

Your next tasks will be to define one or more system drives for the new, available capacity, then to initialize those system drives. Both of these procedures are clearly described in the DACCF 4.2: *DACCF Utilities Installation Guide and User Manual* (Mylex Part Number 771953).

Please refer to the appropriate sections of the above-mentioned document for detailed instructions.

Chapter 3

Using MORE™ with Global Array Manager 2.05

Overview

While Global Array Manager 2.0 allowed system administrators to add logical drives without affecting existing RAID groups, Global Array Manager 2.05 is the first version of this software to include a method for adding capacity to an existing RAID group.

Instead of deleting RAID groups and recreating them with the additional drive(s), new functions called “Auto Expand Capacity” and “Expand Capacity” allow straightforward, automatic expansion of a RAID group by restriping existing RAID group data across a new, target group consisting of more drives.

Installing Global Array Manager 2.05

GAM 2.05 is a maintenance upgrade for users of GAM 2.0. Installation of GAM 2.05 is identical to that of its predecessor, except that it requires the presence of GAM 2.0 to install successfully. Installation instructions will not be repeated in this document.

Refer to the documentation that accompanied GAM 2.0: *Global Array Manager 2 Installation Guide and User Manual* (Mylex Part Number 771961) for detailed installation instructions.

Adding Capacity Under GAM 2.05

MORE is implemented as two additional options on the Administration menu, Auto Expand Capacity and Expand Capacity (Figure 3-1).

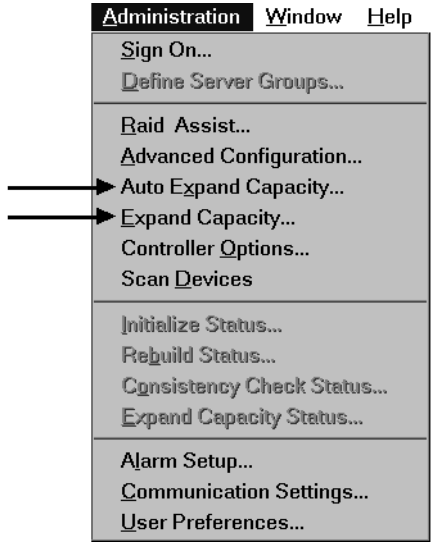

Figure 3-1. Available MORE Functions

Auto Expand Capacity

The Auto Expand Capacity function is an automated process with the following characteristics:

- *All* available (unconfigured) drives will be added to the first existing drive group[1] that qualifies for expanded capacity, as long as the total number of drives will not exceed eight (8).
- Hot spare (standby) drives are not auto-selected. Hot spare status must first be removed before a drive can be added to an existing group.

1. A drive group at RAID 0, 1, 5, or 0+1 with fewer drives than any other drive group and in no case exceeding seven (7) existing drives.

The following example of the use of Auto Expand Capacity will add two unconfigured drives to an existing three-drive RAID group configured as one logical drive. Starting configuration is shown in Figure 3-2.

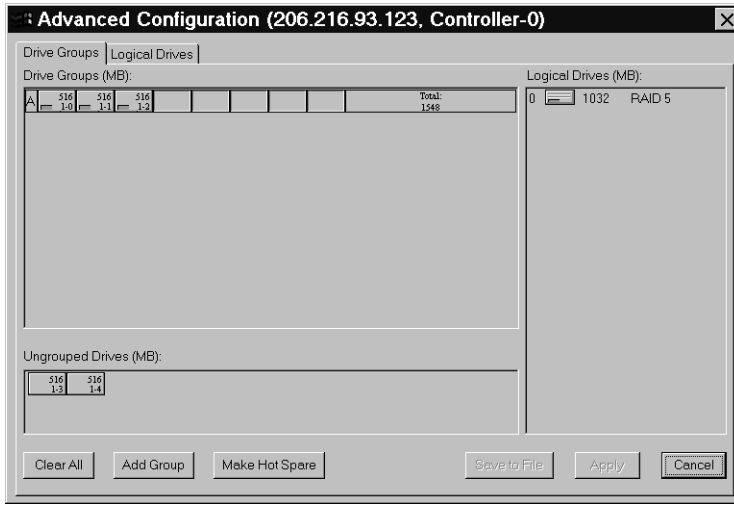

Figure 3-2. Existing Array to Expand

1. Select **Administration, Auto Expand Capacity**. The Auto Expand Capacity dialog box appears (Figure 3-3).

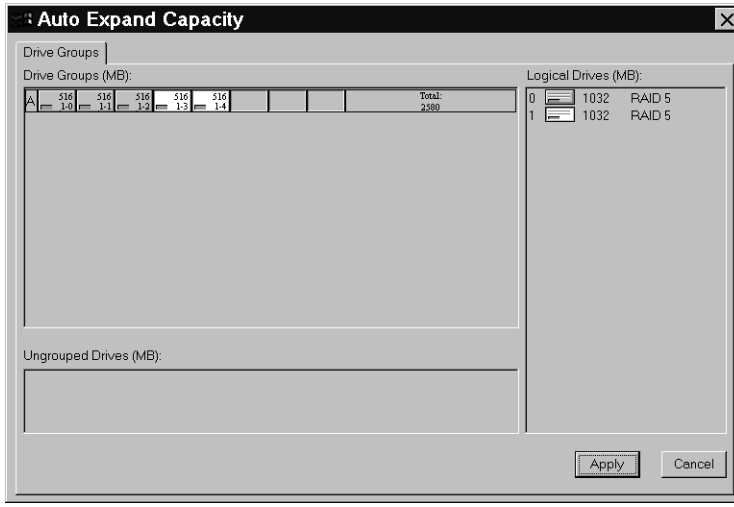

Figure 3-3. Auto Expand Capacity Adds All Unconfigured Drives

Note that both unconfigured drives will be added to the RAID group, and that a new logical drive will be created. The highlight indicates the state of the configuration that will exist if the expansion is accepted.

2. Click Apply to accept the automatic expand capacity configuration shown. The restriping process is ready to begin, and a confirmation message appears (Figure 3-4):

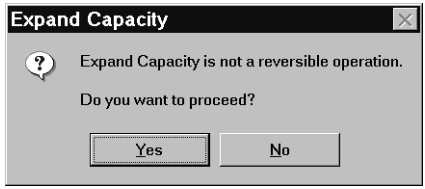

Figure 3-4. Expand Capacity Confirmation Message

3. Click Yes to begin the capacity expansion process on the target RAID group, or click No to cancel the capacity expansion process

Caution

Once the Auto Expand Capacity process has started, it cannot be interrupted by user intervention. You must allow the process to reach completion.

4. If you chose to proceed with expansion, the Expand Capacity Status screen appears, showing the progress of restriping across the target RAID group.

   You may leave the status screen visible throughout the process, or you may click Close to hide it and continue using Global Array Manager. In either case, the expansion process continues to completion.

   Should you wish to view the status screen again after having previously closed it, select **Administration, Expand Capacity Status**.

Expand Capacity

The Expand Capacity function provides user control over the following:

- The number of unconfigured drives that will be added to the selected RAID group
- The RAID group that will be selected for expansion
- The RAID level and write policy of each new logical drive to be created
- Whether to initialize the logical drive automatically after the configuration change has been accepted.

As discussed elsewhere in this document, there are restrictions which the user may not violate when attempting to expand capacity manually:

- The selected RAID group (drive group) must be RAID 0, 1, 5, or 0+1 not exceeding seven (7) existing drives.
- When adding unconfigured drives to a RAID group, the total number of drives in the RAID group should not exceed eight (8).

Refer to “Operating Characteristics of MORE” in Chapter 1 for additional details.

The following example of the use of Expand Capacity will add one unconfigured drive to an existing three-drive RAID group with two RAID 5 logical drives. One *new* logical drive will be created and configured as RAID 0+1 (Mylex RAID 6). Starting configuration is shown in Figure 3-5.

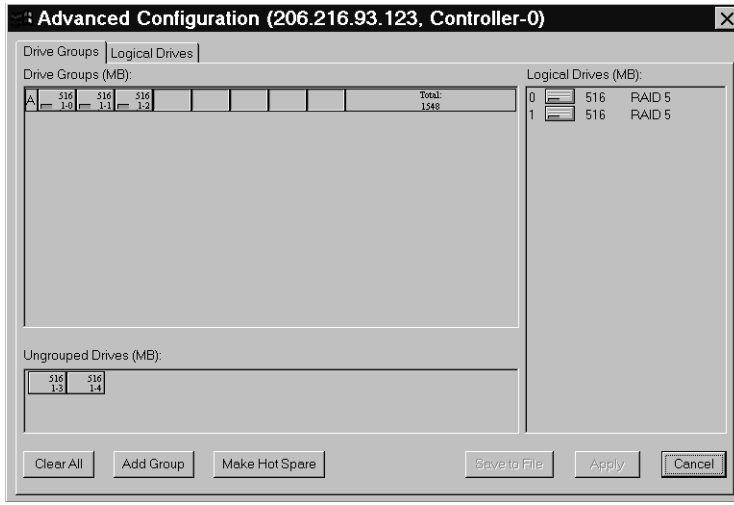

Figure 3-5. Existing Array to Expand

1. Select **Administration, Expand Capacity**. The Expand Capacity dialog box appears (Figure 3-6).

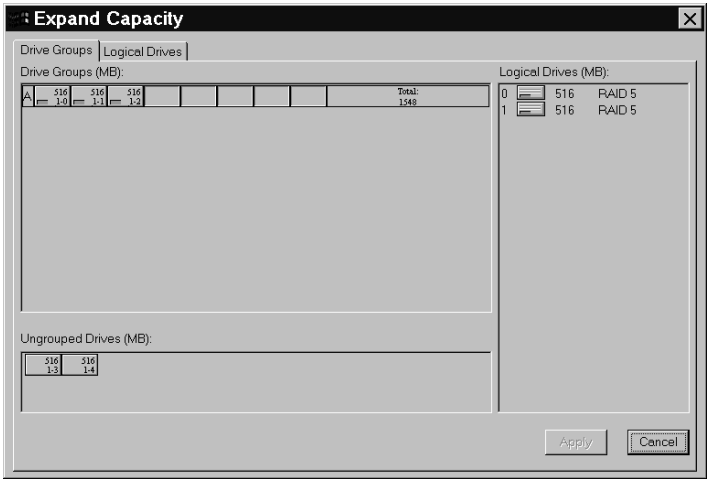

Figure 3-6. Expand Capacity Allows Manual Control

2. Select one of the two unconfigured drive icons by clicking on it and holding down the mouse button. Then drag this drive icon to an empty slot in Drive Group A (Figure 3-7).

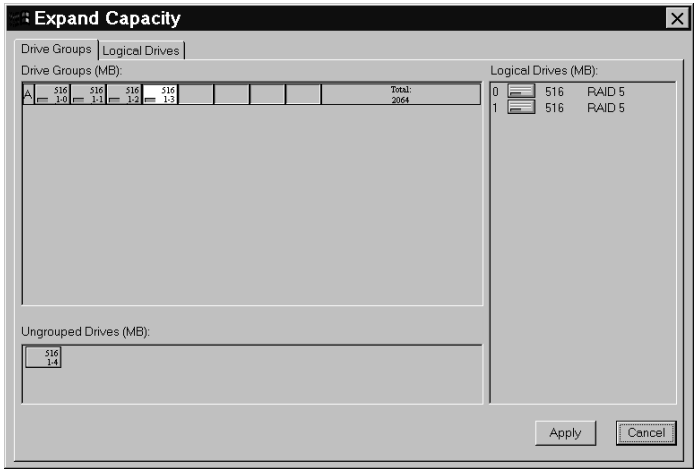

Figure 3-7. One Drive Selected to Expand Drive Group A

3. Now that you've selected the drive to add, click the Logical Drives tab if you wish to configure the new logical drive. The Logical Drives screen appears (Figure 3-8).

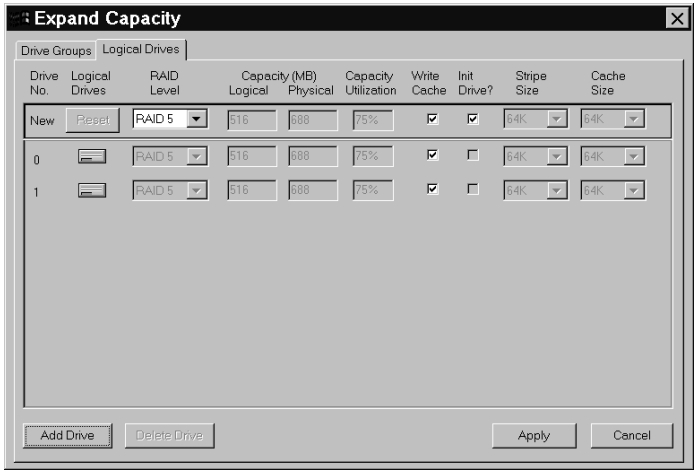

Figure 3-8. Configure RAID Level of the New Logical Drive

4. In the RAID Level box for the new logical drive, select RAID 6 (Mylex equivalent of RAID 0+1). You may toggle Write Policy (checked = Write Back, unchecked = Write Through), and whether to initialize the drive automatically by use of the appropriate check boxes.

5. Click Add Drive to accept the new logical drive configuration. The logical drive is added as Logical Drive 2 in the list (Figure 3-9).

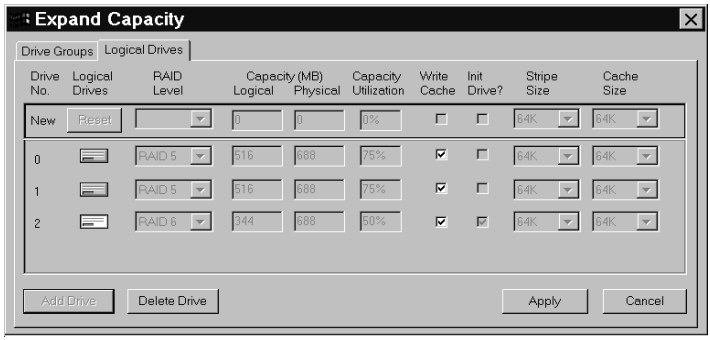

Figure 3-9. New Logical Drive Added to the RAID Group

6. Click Apply to accept the expand capacity configuration shown. The restriping process is ready to begin, and a confirmation message appears (Figure 3-10):

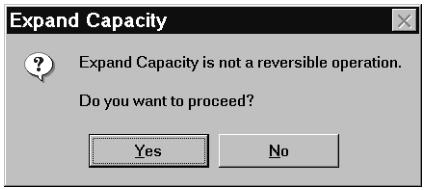

Figure 3-10. Expand Capacity Confirmation Message

7. Click Yes to begin the capacity expansion process on the target RAID group, or click No to cancel the capacity expansion process.

Caution

Once the Expand Capacity process has started, it cannot be interrupted by user intervention. You must allow the process to reach completion.

8. If you chose to proceed with expansion, the Expand Capacity Status screen appears, showing the progress of restriping across the target RAID group.

   You may leave the status screen visible throughout the process, or you may click Close to hide it and continue using Global Array Manager. In either case, the expansion process continues to completion.

   Should you wish to view the status screen again after having previously closed it, select **Administration, Expand Capacity Status**.